

- B3
A4
40. (Amended) A method of storing data values in a multidimensional database comprising:
- identifying a plurality of dimensions, wherein each of the dimensions is indicative of a plurality of storage locations;
 - identifying a hierarchy of attributes within at least one of the dimensions, wherein the hierarchy is indicative of an association between the attributes;
 - attributing a plurality of data values to each of the attributes; and storing the data values on a storage medium on the same disk page as associated data values such that associated values are likely to be retrieved simultaneously, wherein the associated data values are attributed to associated attributes as indicated by the hierarchy.

REMARKS

This Amendment is responsive to the Examiner's action mailed August 27, 2002. Claims 1-40 are pending, of which claims 1, 19, 24 and 36-40 are amended. Claims 1-17 and 24-40 have been rejected under 35 U.S.C. § 103(c). In response, Claims 1, 19, 24 and 36-40 are amended. Claim 24 is subject to an objection and has been amended accordingly. Claims 1, 19, 24 and 36-40 are independent. Formal drawings have also been required, and they are being filed concurrently with this Amendment. Reconsideration is requested.

The Applicants note and appreciate that claims 19-23 would be allowable if rewritten in independent form. Accordingly, claim 19 has been herein amended to include the limitations of the intervening claims. Claims 20-23 continue to depend from amended claim 19.

Claims 1-18 and 24-40 stand rejected under 35 U.S.C. § 103(a) based on Hicks '677 in view of Lore '774. Hicks, however, is inapplicable to the present application because Hicks does not teach or suggest storing associated values such that associated values are likely to be retrieved simultaneously.

In the invention as defined by the present claims, data values are associated with other data values as indicated by a hierarchy. The hierarchy of associations denotes related values, for example, values that are aggregates of each other. Such aggregate values are related because a particular value is comprised of several child values that may be added, or aggregated, to

determine the parent value from the child values, as in monthly sales figures comprising a quarterly sales figure.

When performing an aggregation operation, all associated values are fetched. If the associated data values are stored sporadically on multiple disk pages, many page fetch operations will be required to retrieve those data values. Storing the associated values together, such as on the same disk page, makes it likely that multiple associated values will be retrieved simultaneously in the same page fetch or in a few pages fetches. By increasing the density of associated data values, overall page fetching is reduced, and performance increased, as described in the specification at page 9, lines 1-14.

The Examiner suggests that Hicks teaches storing the data values according to a hierarchy at col. 1, lines 23-30. However, while Hicks recites storing in main memory at line 30, Hicks does not appear to disclose storing according to a hierarchy as employed in the present application. Further, the Examiner concedes in the next paragraph at page 4, line 6 of the office action, that Hicks does not appear to disclose a hierarchy as employed in the present claims. Accordingly, claims 19, 24 and 36-40 have been amended to recite that the storing according to the hierarchy is such that associated values are likely to be retrieved simultaneously, to further clarify and distinguish the invention as defined by the present claims.

The Examiner has further cited Lore '774 as disclosing a hierarchy of attributes (col. 4, lines 42-57). However, this paragraph appears to discuss the sublevels of Lore (line 42) as different from hierarchical levels (line 47). Accordingly, to the extent that Hicks discloses a hierarchy, one skilled in the art would not look to Lore to modify Hicks because Lore teaches away from hierarchical levels.

Inasmuch as Lore teaches sublevels, the Examiner proposes that Lore provides employing the sublevels to process fewer rows to improve system performance (col. 3, lines 66-67). However, the claimed hierarchy is not directed to processing fewer rows, but to reducing page fetches. Accordingly, even if one were to attempt to combine Lore with Hicks, the invention as defined by the present claims would still not be realized because Lore and Hicks do not teach, alone or in combination, storing according to a hierarchy such that associated values are likely to be retrieved simultaneously, as recited in amended claims 1, 24 and 36-40. Accordingly, the

rejection under 35 U.S.C. § 103(a) is believed to be overcome and it is respectfully requested that it be withdrawn.

The Examiner has objected to claim 24 due to informalities. Applicant thanks the Examiner for his observation and claim 24 has been amended accordingly.

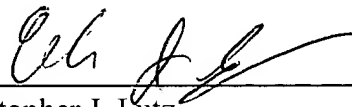
As the remaining claims 2-18 and 25-35 depend, either directly or indirectly from claims 1 and 24, these claims are also now believed allowable as depending from an allowable base claim.

CONCLUSION

In view of the above amendments and remarks, it is believed that all claims are in condition for allowance, and it is respectfully requested that the application be passed to issue. If the Examiner feels that a telephone conference would expedite prosecution of this case, the Examiner is invited to call the undersigned attorney at (978) 341-0036.

Respectfully submitted,

HAMILTON, BROOK, SMITH & REYNOLDS, P.C.

By 

Christopher J. Lutz

Registration No. 44,883

Telephone: (978) 341-0036

Facsimile: (978) 341-0136

Concord, MA 01742-9133

Dated: 11/26/02



MARKED UP VERSION OF AMENDMENTS

Claim Amendments Under 37 C.F.R. § 1.121(c)(1)(ii)

1. (Amended) A method of storing data values in a multidimensional database comprising:
 - identifying a plurality of dimensions, wherein each of the dimensions is indicative of a plurality of storage locations;
 - identifying a hierarchy of attributes within at least one of the dimensions, wherein the hierarchy is indicative of an association between the attributes;
 - attributing a plurality of data values to each of the attributes; and
 - storing the data values on a storage medium based on the data values indicated by the hierarchy, such that associated values are likely to be retrieved simultaneously.

19. (Amended) A method of storing data values in a multidimensional database [The method of Claim 3 further] comprising [the steps of]:
 - identifying a plurality of dimensions, wherein each of the dimensions is indicative of a plurality of storage locations;
 - identifying a hierarchy of attributes within at least one of the dimensions, wherein the hierarchy is indicative of an association between the attributes;
 - attributing a plurality of data values to each of the attributes;
 - storing the data values on a storage medium based on the data values indicated by the hierarchy and stored on the storage medium in proximity to associated data values, wherein the associated data values are attributed to associated attributes as indicated by the hierarchy, the data values further comprising aggregate values and detail values;
 - aggregating at least one of the dimensions having a hierarchy by traversing each of the aggregate values included in the dimension; and
 - including, in an aggregation total, the associated data values corresponding to the aggregate value.

24. (Amended) A system for storing and accessing a multidimensional database comprising:
 - a memory having a cache and a [n] database engine;

a mass storage device in communication with the memory and operable to store a plurality of data values;

a kernel included in the database engine, wherein the kernel is operable to manipulate data values between the memory, the cache, and the mass storage device; and

a sparsity manager included in the database engine, wherein the sparsity manager is operable to determine a storage organization of the data values from a predetermined hierarchy, such that associated values are likely to be retrieved simultaneously.

36. (Amended) A computer program product having computer program code for storing data values in a multidimensional database comprising:

computer program code for identifying a plurality of dimensions, wherein each of the dimensions is indicative of a plurality of storage locations;

computer program code for identifying a hierarchy of attributes within at least one of the dimensions, wherein the hierarchy is indicative of an association between the attributes;

computer program code for attributing a plurality of data values to each of the attributes; and

computer program code for storing the data values on a storage medium in proximity to associated data values, wherein the associated data values are attributed to associated attributes as indicated by the hierarchy, such that associated values are likely to be retrieved simultaneously.

37. (Amended) A computer data signal having program code for storing data values in a multidimensional database comprising:

program code for identifying a plurality of dimensions, wherein each of the dimensions is indicative of a plurality of storage locations;

program code for identifying a hierarchy of attributes within at least one of the dimensions, wherein the hierarchy is indicative of an association between the attributes;

program code for attributing a plurality of data values to each of the attributes; and

program code for storing the data values on a storage medium in proximity to associated data values, wherein the associated data values are attributed to associated

attributes as indicated by the hierarchy, such that associated values are likely to be retrieved simultaneously.

38. (Amended) A system for storing data values in a multidimensional database comprising:
- means for identifying a plurality of dimensions, wherein each of the dimensions is indicative of a plurality of storage locations;
 - means for identifying a hierarchy of attributes within at least one of the dimensions, wherein the hierarchy is indicative of an association between the attributes;
 - means for attributing a plurality of data values to each of the attributes; and
 - means for storing the data values on a storage medium in proximity to associated data values, wherein the associated data values are attributed to associated attributes as indicated by the hierarchy, such that associated values are likely to be retrieved simultaneously.
39. (Amended) A method of storing data values in a multidimensional database comprising:
- identifying a plurality of dimensions, wherein each of the dimensions is indicative of a plurality of attributes associated with a data value;
 - identifying a hierarchy within at least one of the dimensions, wherein the hierarchy is indicative of an association between the plurality of attributes;
 - assigning a plurality of data values to each of the plurality of attributes;
 - storing the data values on a storage medium in proximity to associated data values, wherein the associated data values are assigned to associated attributes as indicated by the hierarchy, such that associated values are likely to be retrieved simultaneously.
40. (Amended) A method of storing data values in a multidimensional database comprising:
- identifying a plurality of dimensions, wherein each of the dimensions is indicative of a plurality of storage locations;
 - identifying a hierarchy of attributes within at least one of the dimensions, wherein the hierarchy is indicative of an association between the attributes;
 - attributing a plurality of data values to each of the attributes; and storing the data values on a storage medium on the same disk page as associated data values such that

associated values are likely to be retrieved simultaneously, wherein the associated data values are attributed to associated attributes as indicated by the hierarchy.